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Line guide device

The invention relates to a line guide device for guiding lines, comprising a plurality of links connected to each other in articulated fashion, each of which displays a bottom element, opposite side walls and at least one cover element, forming a duct for accommodating lines, where the plurality of links are integrally moulded on one another in one piece, forming a continuous strand, where the line guide device can be arranged to form a lower run, a curved section and an upper run, and where the bottom element and both opposite side walls of the links are designed in one piece as U-sections that are essentially rigid under the intended loads, and where the cover element of the respective link is integrally moulded on at least one side wall of said link and designed to be moveable relative to the side wall, and can be moved into a position closing the link and a position at least essentially releasing the area between the opposite side walls.

Line guide devices of one-piece design of this kind that extend over a plurality of links connected to each other in articulated fashion are often manufactured as extruded sections, where the side walls of the extruded section are machined in order to form the individual links, e.g. by making notches. Line guide devices of this kind are usually relatively flexible, partly in order to permit easy arrangement of the lines to be guided in the duct of the line guide device. On the other hand, however, this results in relatively low stability of the

links, especially in the event of torsional stress or laterally acting forces. Furthermore, complex structuring of the links of the extruded sections involves a great effort, or is completely impossible, meaning that there are limits to the adaptation of the line guide device to different requirements or other functions.

Furthermore, line guide devices have become known that are made of plastic and injection-moulded in one piece, essentially in a roughly plane arrangement. The bottom element, the side walls and the cover element are in this case each connected to each other by joint elements in the manner of film hinges. While this permits manufacture of a line guide device at low cost, the line guide device is, however, comparatively unstable on the whole when exposed to external forces, which are also exerted on the line guide device during travel motion thereof, meaning that it is not suitable for all applications. This particularly applies in cases where the line guide device only has a cross-section of very small dimensions, this being necessary for many applications, e.g. in the automotive sector, for printers or the like.

EP 1 138 555 B1 describes a device for carrying and guiding a bundle of wires that is firmly connected to a part, such as the seat part of a front seat for motor vehicles, and moveable relative to a carrier, and which contains a flexible, curved belt in the form of a trough for accommodating the bundle of wires, which is located below the moveable part in a plane running approximately perpendicular to the carrier, and the lower end of which is firmly connected to a supporting plate, which can be fastened to the carrier, where fastening means for enclosing the bundle of wires in the trough-shaped belt are provided, such that the bundle of wires and the belt are deformable in at least two orthogonal directions running perpendicular to the carrier and parallel to it.

The object of the invention is therefore to provide a line guide device that can be manufactured at low cost and used for a wide variety of purposes, even with relatively small cross-sections of the links.

The object is solved by a line guide device with the characteristics of Claim 1. The links are thus manufactured as essentially rigid U-sections, which are present in a one-piece strand of the line guide device, such that the line guide device displays high stability even if the links are relatively small. Owing to the high stability of the links and their being integrally moulded on one another in one piece, even a line guide device with a very small link cross-section can display very quiet running and uniform movement. In this context, the links of the line guide device can have a width and/or height of $\leq$ 2 cm, $\leq$ 1.5 cm or $\leq$ 0.5-1 cm. It thus goes without saying that the U-sections of the links, which are essentially rigid under the intended loads, can nevertheless be deformable to at least a certain degree, if appropriate, either manually or under elevated loads. On the other hand, with such small links,

closing element can, in particular, be designed as a tab that can be fixed in place by a snap fit.

Adjacent links are provided with stops that correspond to each other and can come into contact with each other when the line guide device is in the straight position. In this context, the line guide device can be in essentially linear, straight position and display a certain degree of pretension, such that a straight position is only obtained when a pressure load is exerted on the upper side of the bottom elements, e.g. by lines arranged in the line guide device. The face ends of the side walls of the links that face the adjacent link often serve as stop faces. This is, however, sometimes not expedient in the case of links with a relatively small cross-section and thus a small width of the side walls. Consequently, at least one of the corresponding stops of adjacent links is preferably provided on a cover element. A corresponding stop of the adjacent link can, for example, likewise be located on a cover element, or on an inner side, outer side and/or an upper side of the side wall facing away from the bottom element of the link. The line guide device can in each case be designed in such a way that the upper run can be deposited on the lower run, or that the upper run is suspended freely.

The cover elements can, for example, display projections that reach over the adjacent link and act on an upper side of a side wall of an adjacent link, forming a stop, e.g. engage a recess in the side wall that is open towards the top. The stops on the cover element can essentially display the width of the side walls of the adjacent link or, if appropriate, the side walls can display areas with a wider cross-section that serve as stops.

According to the invention, the respectively corresponding stops of adjacent links, which act in the straight position and/or curved position of the line guide device and, in this

context, limit the pivoting position of the links in the respective direction, are in each case located on both cover elements of the respectively adjacent links. Integral moulding of the stops on the side walls is no longer necessary as a result. Furthermore, the stops can be located roughly, or exactly, at the level of the longitudinal mid-plane of the line guide device, i.e. at an at least roughly, or exactly, equal distance from the respectively opposite side walls of a link, as a result of which the stops display a relatively large stop face and their central position on the line guide device avoids non-uniform contact behaviour of laterally separated pairs of stops.

The stop is preferably designed as an area projecting from the respective cover element, which, in straight position of the line guide device, projects onto the adjacent link and, in stop position, engages a recess provided with a stop in a cover element and/or a side wall of the adjacent link. One stop of a pair of stops of adjacent links that acts in straight position can be provided by a recess in the respective cover element that is open towards the adjacent link, where the recess is preferably designed to be at least partly, or completely, closed in the direction of the bottom element of the respective link. In stop position, this prevents the stop of the adjacent link from slipping off towards the bottom element of the link. If appropriate, the recess in the cover element that accommodates the stop of the adjacent link can also be designed to be at least partly, or completely, closed towards the top.

According to the invention, the side walls and/or cover elements of at least some, or all, links are alternatively or additionally provided with tabs integrally moulded in one piece, which, starting from a first position corresponding, for example, to the position of the tab in the respective mould, e.g. an injection mould, by means of which the line guide device is manufactured, can be moved into a second position, in which

they overlap a partial area of an adjacent link. This makes it possible to provide overlapping areas of adjacent links without having to produce overlapping areas of the links during manufacture of the line guide device in a mould, such as an injection mould, this usually being a highly complex task in terms of mould design. The overlapping areas can, for example, each provide one stop of a pair of stops of adjacent links that acts in the straight position and/or the maximally curved position of the line guide device.

In the area of the essentially rigid side walls and the bottom elements, the links preferably display no overlapping areas, apart from the aforementioned moveable tabs, where appropriate.

The one-piece section of the line guide device, displaying a plurality of links, is preferably moulded in such a way that the cover elements are in each case alternately integrally moulded on opposite side walls of the links.

At least some, or all, cover elements of the links are preferably provided with at least one integrally moulded tab-like area, which forms overlapping areas with at least one of the respectively adjacent links in the straight and/or maximally curved position of the line guide device, where stop elements acting in the respective stop position are located on the overlapping areas of the respectively adjacent links. In particular, some or all cover elements of the links can each have two integrally moulded tab-like areas, each of which projects onto one of the two adjacent links, forming overlapping areas with them. The tab-like areas thus border on the cover elements at the level of the hinge joints, such that the cover elements display a greater extension in the longitudinal direction of the line guide device at the level of the tabs than at the level of the hinge joints to the side